National Biological Assessment and Criteria Workshop

Advancing State and Tribal Programs

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RFC 201

Development of a Reference Site Screening Approach

Part 2

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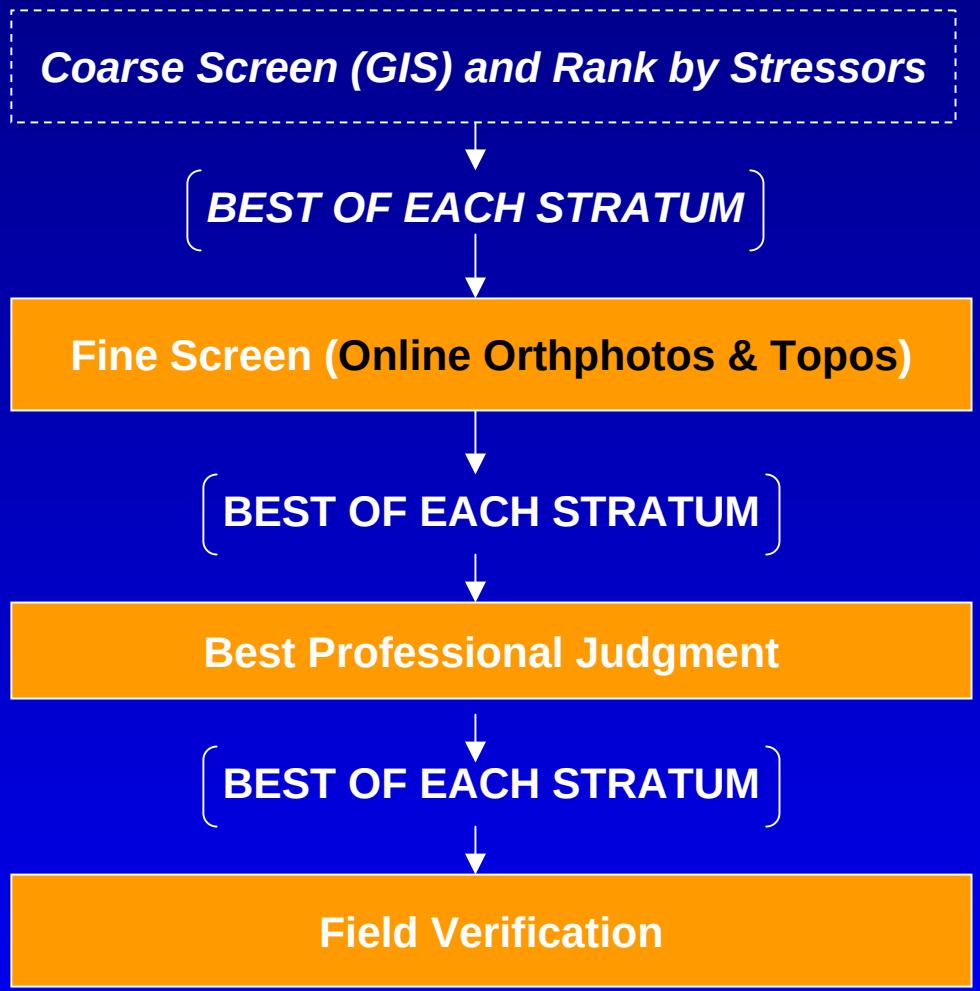
Project objectives - REVIEW

- Develop a ‘top-down’ reference stream reach screening approach for states/regions
- Identify ‘least disturbed’ reference sites within any biophysical stratum
- Keys: practical, based on readily available data, reproducible, regionally flexible

Fine Screen Goals

- Reasonably objective process
- Reasonably reproducible
- Based on explicit criteria
- Screen out sites with increasing detailed information

Conceptual Approach



(REACHES)

Hundreds of thousands

Hundreds

Tens to hundreds

Tens

Fine Screening

- Operational Definition: Evaluation of a set of the *least disturbed* Coarse Screened reaches using available online digital orthophotos and topographic maps, to create a ranked list by estimated level of stressors in the network, stratified by ecoregion and stream order.

Representing Disturbances

- During Coarse Screening – buffer zones around disturbances crudely depicted potential impact on stream networks
- During Fine Screening:
  - ✓ Estimates made for the reach and the upstream contributing areas
  - ✓ Standardized severity scoring minimizes variability
  - ✓ Type and severity of disturbance are recorded
  - ✓ Photointerpreted judgment used to assess local conditions (e.g., soils, slope, etc.) affecting severity score

Standardized Disturbance Criteria Development

- Identify characteristic disturbances that can be interpreted from the orthophoto imagery
  - ✓ Type
  - ✓ Severity
- Scoring criteria should reflect both intensity and extent of potential disturbance impacts
- Ideally the final tally should crudely represent relative impacts

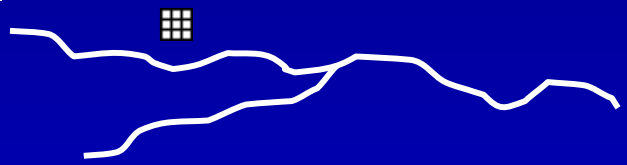
Example Scoring Criteria

NOT DETECTED	**(0)**	**= not detected in imagery**
LOW	**(1)**	**= present, impact unlikely due to distance or riparian buffer; or light and localized impact**
	(5)	**= low impact probable**
MODERATE	**(10)**	**= low impact obvious for most of stream; or high but concentrated impact**
HIGH	**(20)**	**= moderate impact for most of stream; or very high but concentrated impact**
SEVERE	**(40)**	**= high impact for most of stream; or severe concentrated impact**

What Might This Look Like?

SEVERITY SCORE

(1)



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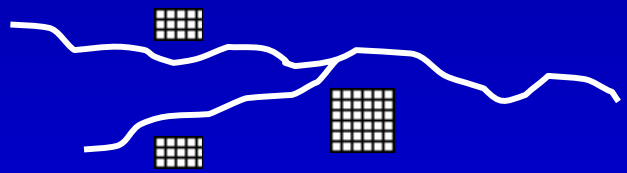

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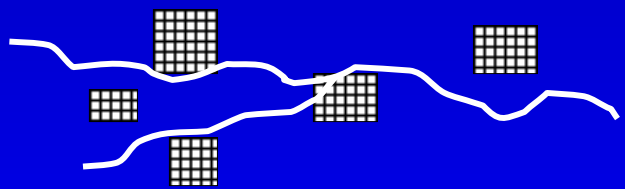

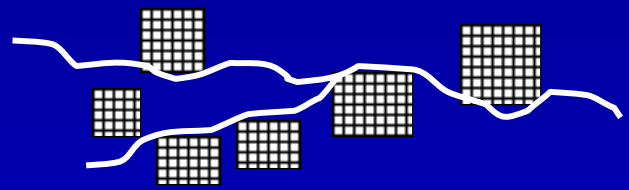

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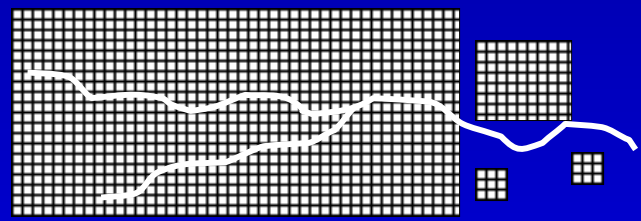


(40)

Example Ranges on Scores

Urban/Residential Development	=	1 – 40
Commercial/Industrial	=	1 – 40
Roads	=	1 – 40
OHV trails	=	1 – 20
Pack trails	=	1 – 5
Railroads / Powerlines	=	1 – 10
Agriculture	=	1 – 40
Grazing	=	1 – 40
Confined animal feeding operations	=	10 – 40
Logging	=	1 – 40
Irrigation withdrawals	=	5 – 40
Water diversions	=	10 – 40
Impoundments	=	1 – 40
Rock / gravel extraction	=	1 – 40
Mineral/oil extraction	=	10 – 40

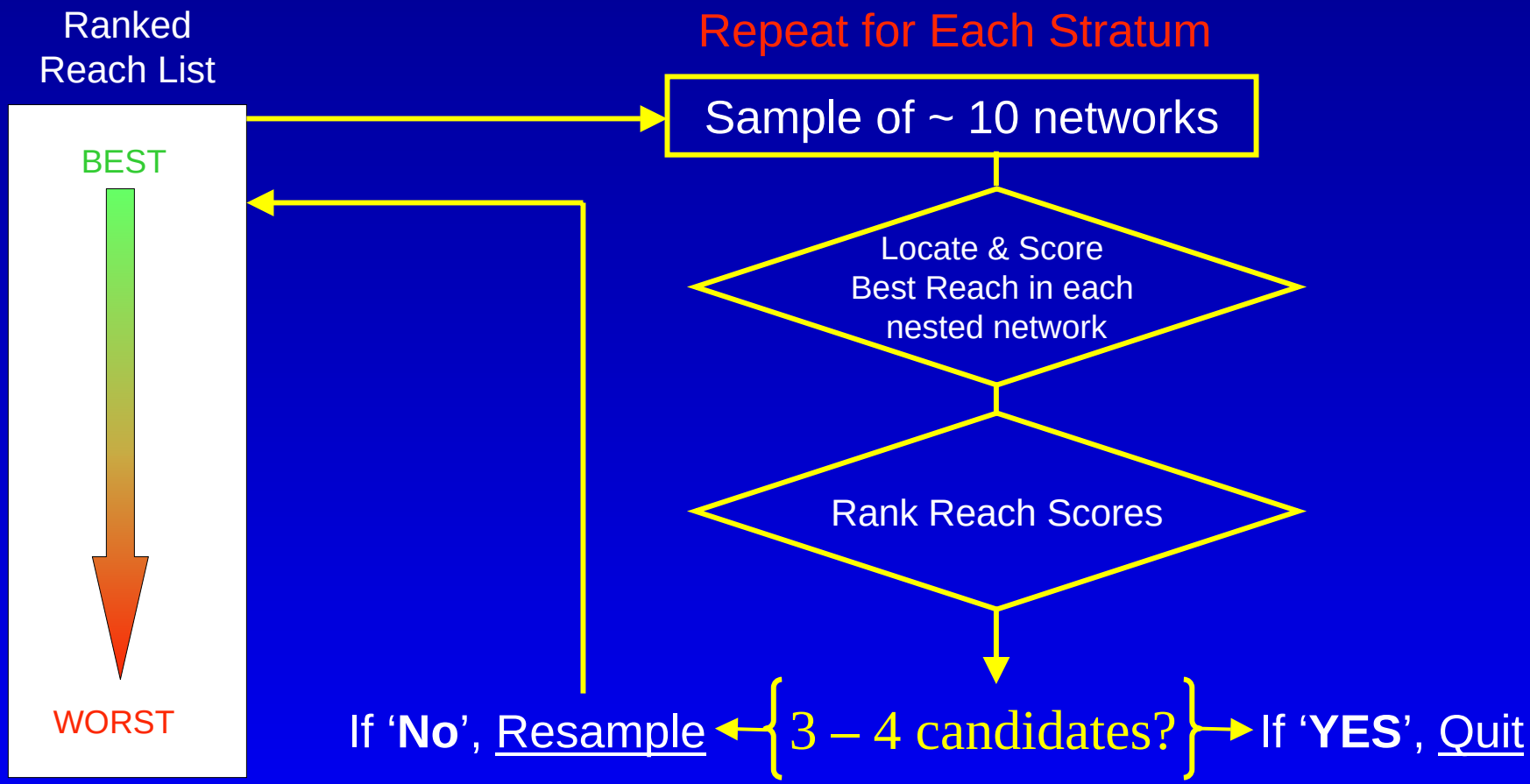
Atypical Disturbances …

Useful Data Sources

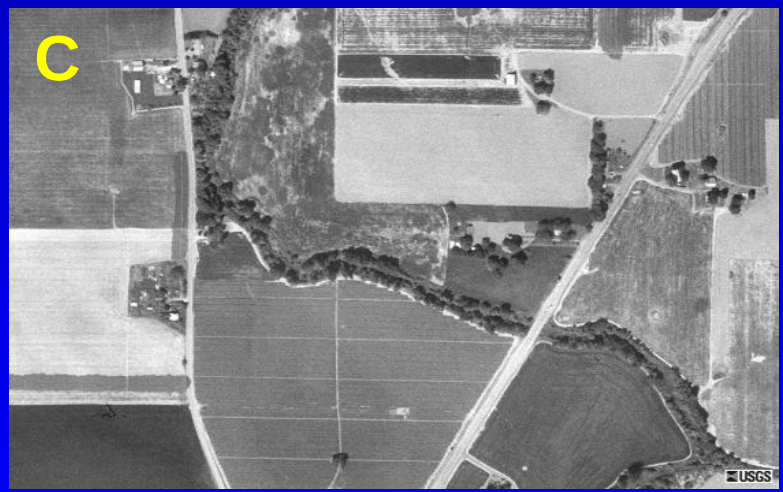
- Digital orthophoto quads (e.g., TerraServer)
- Digital topographic maps (e.g., TerraServer, TopoZone)
- Air Photos
- BPJ recommendations
- Aerial and ground reconnaissance

The Basic Fine Screen Process

From Coarse Screen or BPJ:



Rapid Visual Screen to Identify the Least Disturbed Reach in the Network



Example Screening Form

Fine-Level Screening Form

REACH-ID _____ NETWORK-ID# _____
% Disturbed _____.___% Date:_____ Screener _____
Strahler Order 1 2 3 4 5 Ecoregion _____

Access Issues:
< 2km to reach? Yes / No If no, estimate distance:_____
Is topography dangerous? Yes / No
Is there public access to the reach? Yes / No

Exclusionary Criteria: No impediments ____
Major Mine(s) present ____ Major upstream dam present ____
Reach is artificial channel _____

Disturbance type	Severity	Location			Row Total
		Down	Reach	Upstrm	
Column Totals:					

Grand Total: ____

- **Header Information**
- **Access Information**
- **Rapid Exclusionary Criteria**
- **Detailed Disturbance Type and Severity Information**
- **Fine Screen Score**

Fine Screen Site Ranking

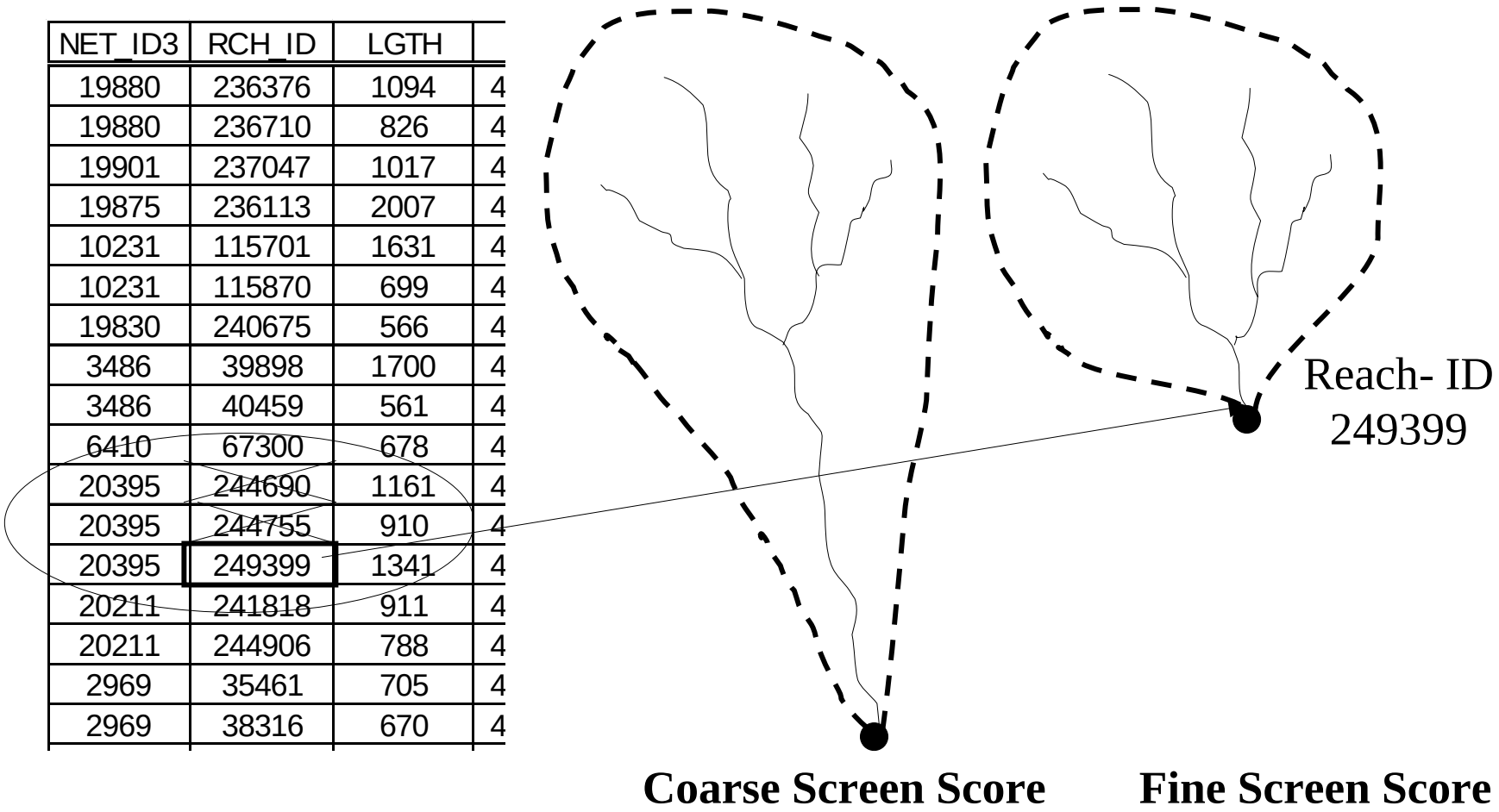
- Rank by ascending total score
- Best 3- 4 candidates (lowest scores) from each stratum are selected for BPJ review
  - ✓ Attempt to avoid spatial autocorrelation
  - ✓ Certain selection criteria may need to be relaxed to get sufficient samples
- Weighting issues, upstream vs. reach (*under consideration*)
  - ✓ Example: 1st order vs. 5th order catchments

Why Do Coarse and Fine Scores Differ?

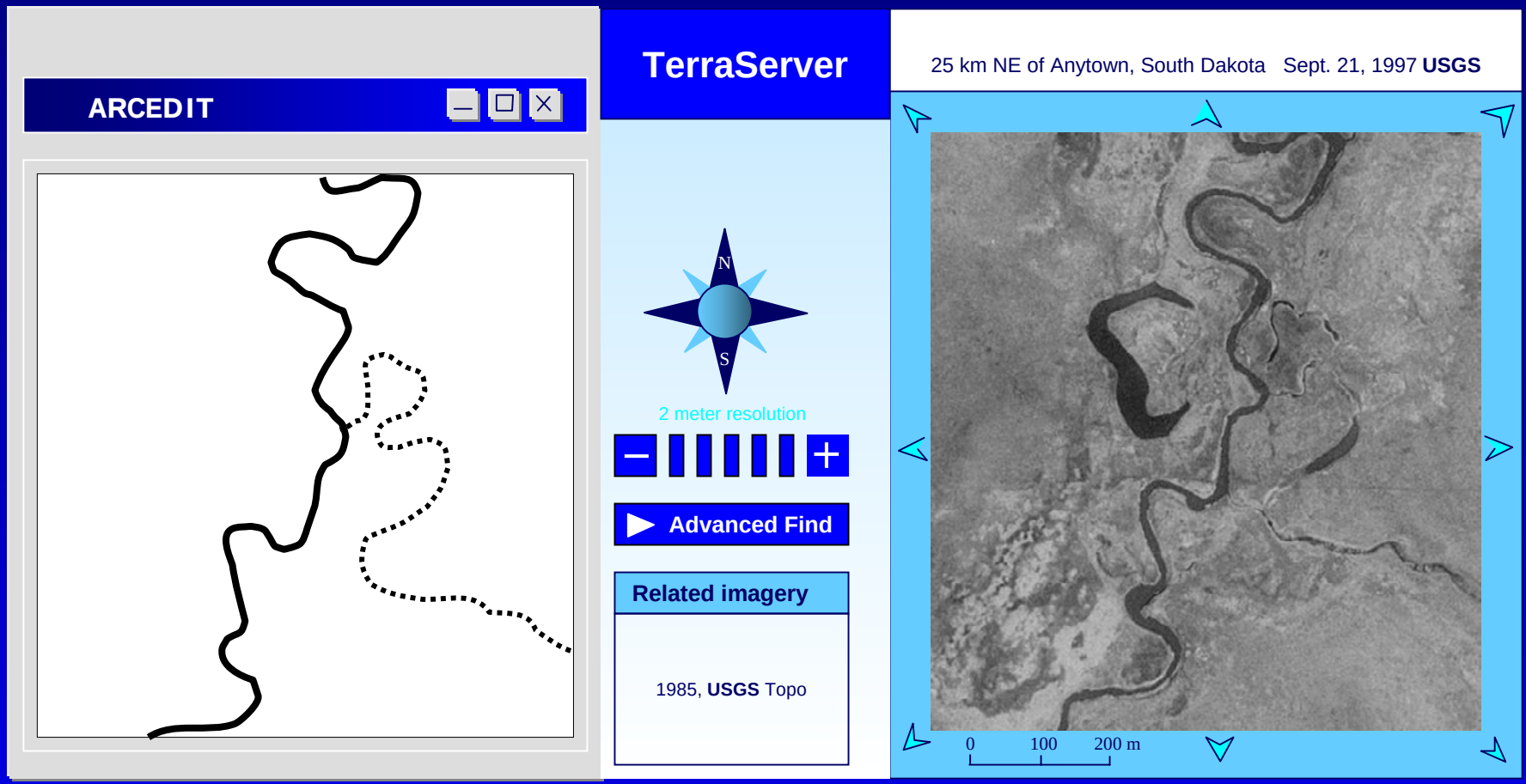
- Data resolution
- GIS operations vs. photo interpretation
- Different operational definitions of zones of potential impact (buffers vs. interpreter judgment)
- Entire network disturbance (Coarse Screening) vs. just disturbance above reach pour point (Fine Screening)

Ranked Reach List

NET_ID3	RCH_ID	LGTH	
19880	236376	1094	4
19880	236710	826	4
19901	237047	1017	4
19875	236113	2007	4
10231	115701	1631	4
10231	115870	699	4
19830	240675	566	4
3486	39898	1700	4
3486	40459	561	4
6410	67300	678	4
20395	244690	1161	4
20395	244755	910	4
20395	249399	1341	4
20211	241818	911	4
20211	244906	788	4
2969	35461	705	4
2969	38316	670	4



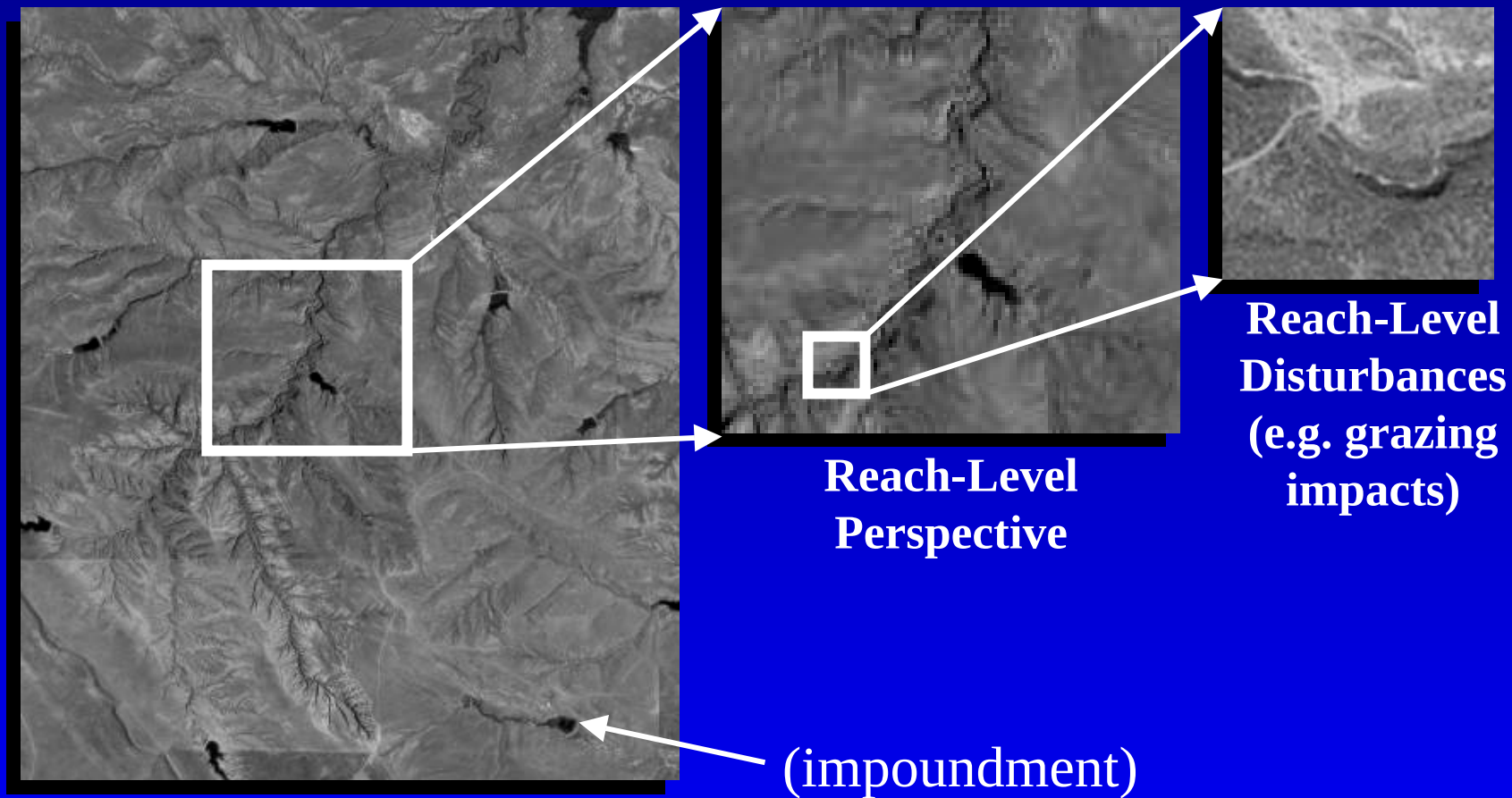
Simplified Split-Screen Work Environment



Typical Screen Shot

TerraServer Orthophoto – Convenient Zoom

(Reach-Level to Watershed-Level Disturbances)



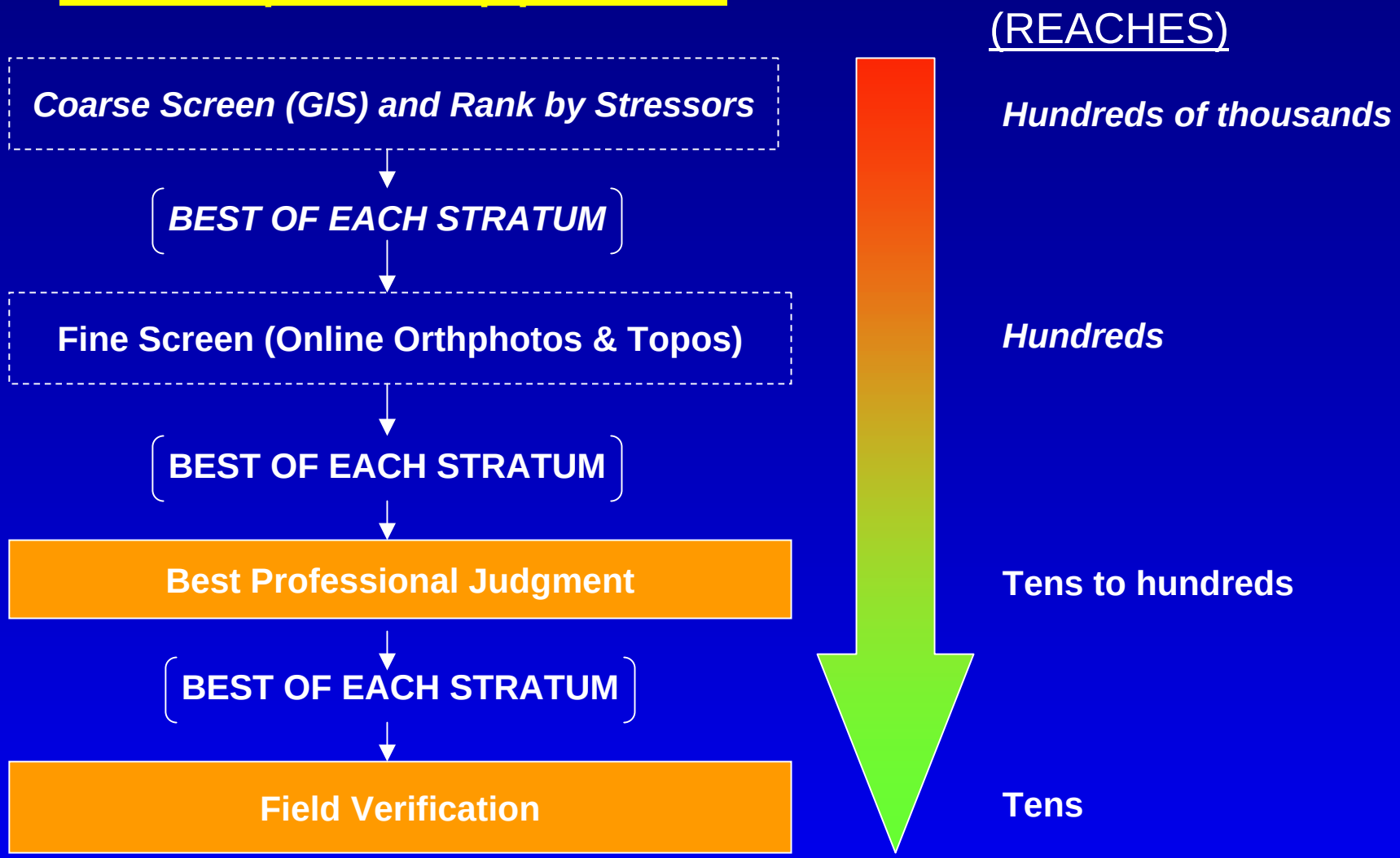
Advantages of Online Orthophotos

- More rapid than field reconnaissance
- Easy movement between sample areas and scales
- Saves hard disk space
- Free (online)
- Level of detail (1m resolution is useful for many stressors (e.g., road washouts, grazing impacts)

Fine Screen Output

- ~ 3 – 4 candidates from each stratum (e.g., stream order x ecoregion)
- Mapped locations of reaches
- List of local contacts for BPJ review of sites

Conceptual Approach



The BPJ Process

- Local contacts established
- Contacts are provided with
  - ✓ Maps & site information (approximate catchment boundaries, reach)
  - ✓ Scoring instructions
  - ✓ Standardized scoring sheets
- The best BPJ sites (perennial and 'least disturbed') from each stratum are identified for field inspection

The BPJ Step

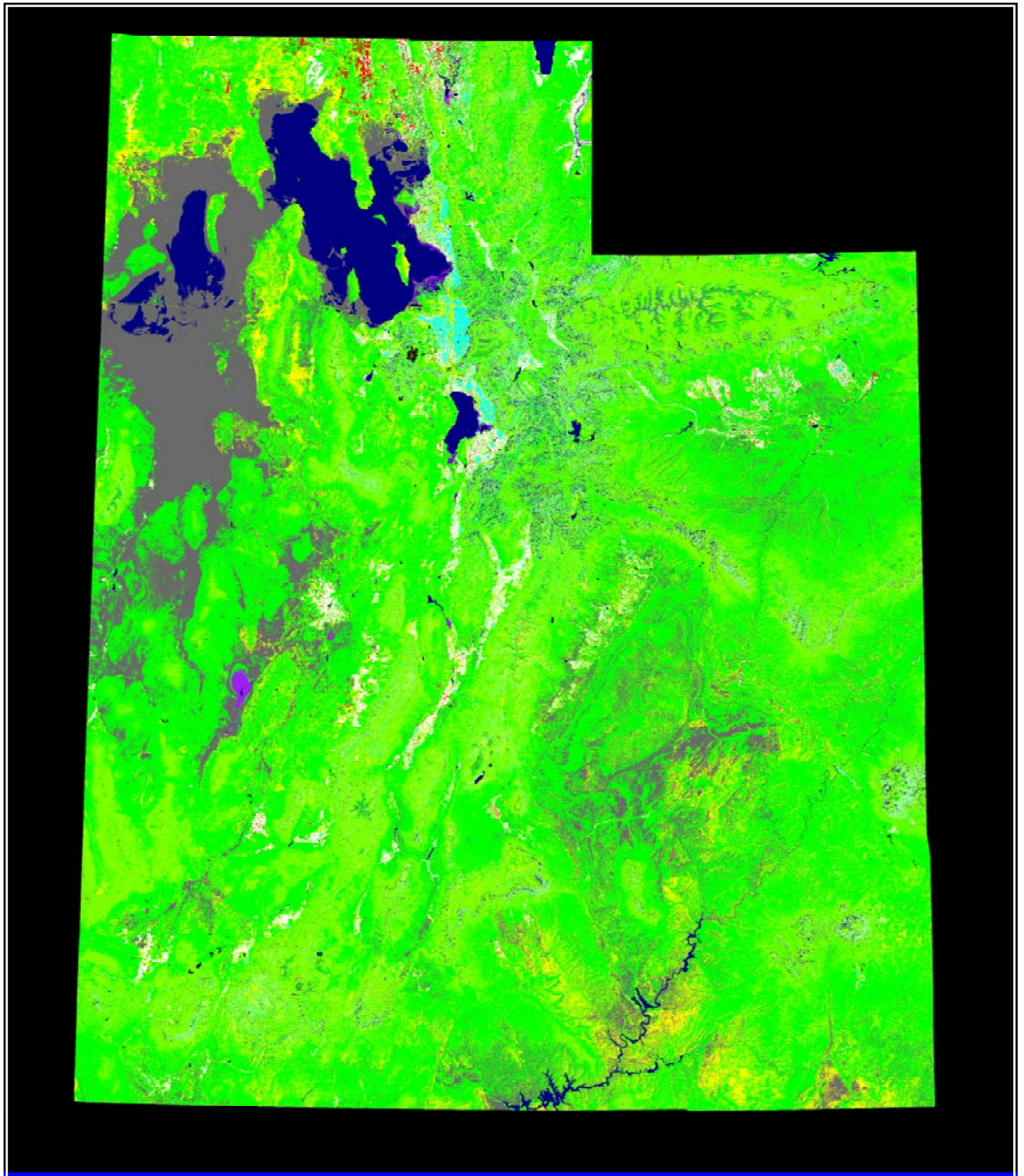
- Best Professional Judgment
  - ✓ Reach and catchment stressors are scored, comparable to the Fine Screen step
  - ✓ Detailed information not always available in GIS data or interpreted from orthophotos (e.g., historical perspective)
  - ✓ Confirmation of flow status
  - ✓ Confirmation that stream is representative of 'least disturbed'
  - ✓ Access information / contacts
  - ✓ Alternate potential reference candidates solicited

Field Reconnaissance

- Sites with the lowest scores from each stratum are field inspected via:
  - ✓ Aerial reconnaissance of the watershed
    - Videotaped for post season debriefing and review
  - ✓ Ground truthing of the reach
    - Trained field crews to reduce variability in scoring
    - Standardized scoring data sheet
    - Photographs for assessment of variability between crews
    - Confirmation of flow status

The Final Fine Screen Product:

- Recommended list of candidate reaches for future field sampling



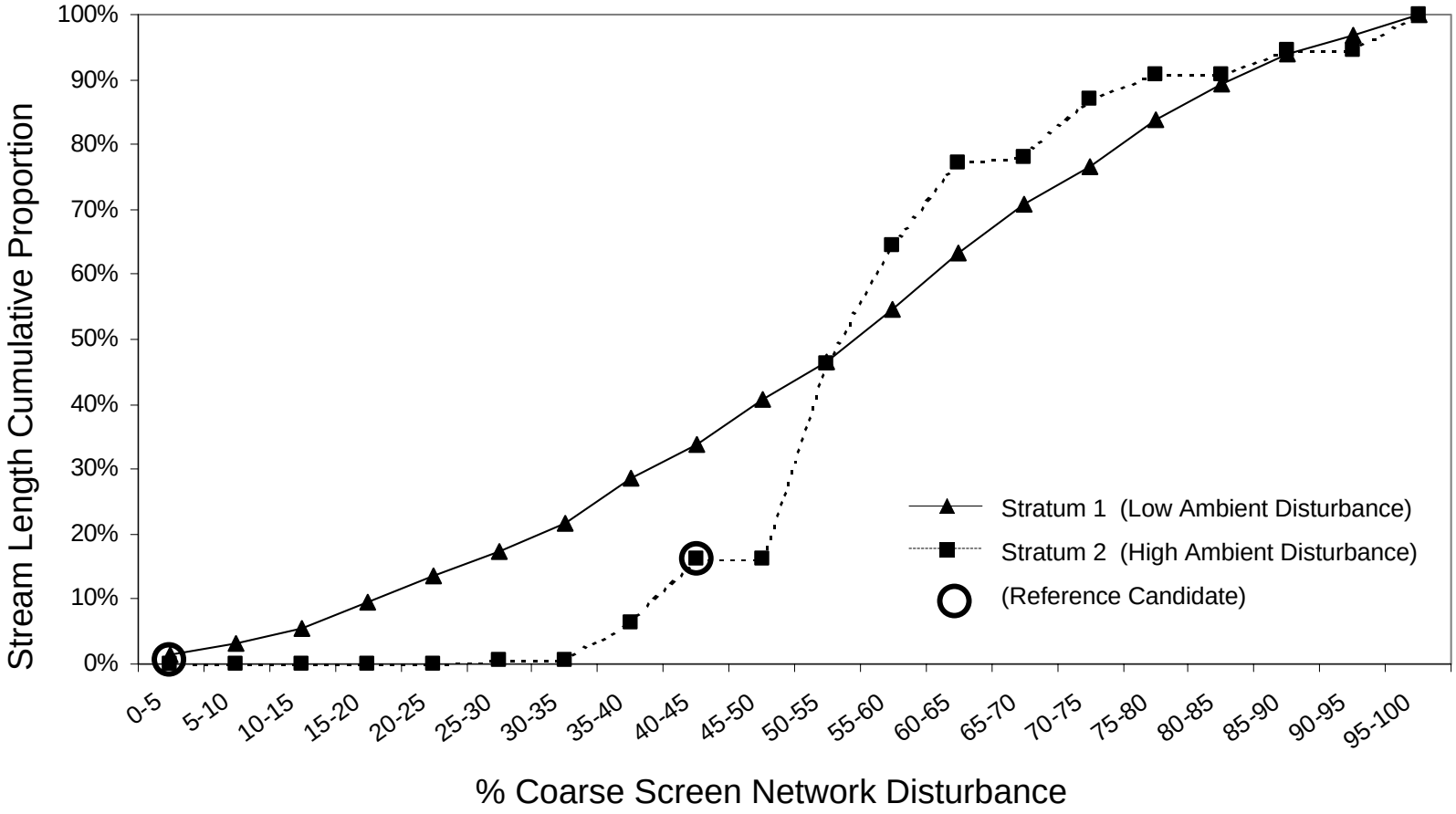
Utah State Pilot

(2001 – 2002)

Fine Screen Step:

- 400 perennial reaches screened (28 strata)
- 80 Evaluated by BPJ
- BPJ recommended 42 (19 strata)
- 35 inspected by air
- 18 sites were field inspected
- 78% of field scores were < or = the BPJ score
- 20 reference candidates (19 strata) were identified for future field sampling

Example –Two Strata (Utah Pilot)



Least Disturbed Sites in Highly Disturbed Settings

- The quality of 'least disturbed' candidates will vary between strata, depending upon ambient disturbance level
- Recommendation: Assign a relative quality rating to each site (high quality/minimally disturbed, average, low quality)
- For regions where only low quality sites are available, consider alternate approaches for defining reference condition, as explored in RFC 202

Skills Needed

- General GIS skills
- Photo interpretation skills
- General understanding of stressors and their impacts on aquatic ecosystems

- Summary -

- Multi-stage, multi-scale process
- The best Coarse Screened reaches for each stratum are Fine Screened
- The best Fine Screened reaches from each stratum evaluated using structured BPJ
- BPJ scores, confirms flow and 'least disturbed' status
- Best BPJ sites from each stratum are ground truthed:
  - ✓ Aerial inspection of the watershed
  - ✓ Field inspection of the reach
- A final list of candidate reference sites is prepared